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Matsushima et al.

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(54) **LENTICULAR LENS SHEET, DISPLAY APPARATUS AND ELECTRONIC EQUIPMENT**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,859,757 B2 * 12/2010 Yamamura B41J 2/451
359/621
8,508,852 B2 * 8/2013 Okumura G02B 3/06
359/619
8,817,202 B2 * 8/2014 Okumura B29D 11/00365
349/57
2008/0068720 A1 3/2008 Shigemura et al.
2009/0116116 A1 5/2009 Tomikawa et al.

FOREIGN PATENT DOCUMENTS

JP 2008-070760 A 3/2008
JP 2009-115920 A 5/2009
JP 2011-232446 A 11/2011

* cited by examiner

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(57) **ABSTRACT**

Provided are a lenticular lens sheet capable of simultaneously achieving an improvement in visibility due to improving bonding accuracy, and low cost due to shape stabilization during processing the lens, a display apparatus and an electronic equipment including the same. The lenticular lens sheet includes a plurality of cylindrical lenses which extend in a direction parallel to each other; and an alignment mark which has two cylindrical lenses among the plurality of cylindrical lenses, a flat part disposed between the two cylindrical lenses, and a structure which is disposed on the flat part and extends between the two cylindrical lenses.

13 Claims, 55 Drawing Sheets

